CLAIMS

Sub A1

1. A method for forming a shaped component from liquid metal alloy, comprising the steps of:

cooling the alloy to a temperature below its liquidus temperature whilst applying shear at a sufficiently high shear rate and intensity of turbulence to convert the alloy into its thixotropic state, and

subsequently transferring the alloy into a mould to form a shaped component,

wherein shear is applied to the alloy by means of an extruder having at least two screws which are at least partially intermeshed.

2. A method as claimed in claim 1, wherein the screws are substantially fully intermeshed.

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3. A method as claimed in claims 1 or 2, wherein the alloy is fed into the extruder at a temperature higher than its liquidus temperature.

4. A method as claimed in any preceding claim, wherein, prior to being transferred into the mould, the alloy is transferred into a shot assembly which injects the alloy into the mould.

5. A method as claimed in any preceding claim, wherein the temperature of the alloy whilst it is being sheared is maintained between the liquidus and solidus temperatures of the alloy, such that the alloy is in a semisolid state.

6. A method as claimed in claim 5, wherein the solid volume fraction in the alloy whilst it is in the extruder is from 5 to 95%.

7. Apparatus for forming a shaped component from liquid metal alloy, comprising a temperature-controlled extruder able to impart sufficient shear and intensity of turbulence

to a liquid metal alloy to convert it into its thixotropic state, a shot assembly in fluid communication with the extruder, and a mould in fluid communication with the shot assembly, wherein the extruder has at least two screws which are at least partially intermeshed.

8. Apparatus as claimed in claim 7, additionally comprising a feeder for feeding the liquid metal alloy into the extruder.

9. Apparatus as claimed in claim 8, wherein the feeder has means for containing and maintaining the alloy at a temperature above the liquidus temperature.

10. Apparatus as claimed in any of claims 7 to 9, wherein the extruder has a barrel and a pair of screws, the inner surface of said barrel and the outer surface of said screws are resistant to corrosion and erosion by liquid alloys, said screws each including a shaft having at least one vane thereon, said vane at least partially defining a helix around said shaft to propel the alloy through said barrel.

11. Apparatus as claimed in any of claims 7 to 10, having an electric or hydraulic motor for rotating said screws and shearing said alloy at a shear rate and intensity of turbulence sufficient to inhibit complete formation of dendritic structures therein while said alloy is in a semisolid state, the rotation of said screws by said electric or hydraulic motor also causing said alloy to be transported from one end to another end of said barrel.

12. Apparatus as claimed any of claims 7 to 11, including temperature controllable means for transferring heat to said extruder barrel, said screws and said alloy, such that said alloy is in a semisolid state and at a temperature between the liquidus and solidus temperatures of said alloy.

13. Apparatus as claimed in any of claims 7 to 12, including a control valve between the extruder and the shot assembly for discharging said alloy from said extruder to a shot sleeve in a cylinder-piston assembly.

Sub A3 cont

14. Apparatus as claimed in any of claims 7 to 13, wherein the extruder barrel has an inner layer which is mechanically bonded to an outer layer of said barrel by shrink fitting.

15. Apparatus as claimed in any of claims 7 to 14, wherein said extruder barrel is a monolithic component formed from sialon ceramic.

16. Apparatus as claimed in any of claims 7 to 15, wherein all surfaces and the inner layer of said apparatus in contact with the semisolid alloy are formed from sialon ceramic.

17. Apparatus as claimed in any of claims 7 to 16 wherein said outer layer of said barrel is tool steel H11, H13 or H21.

18. Apparatus as claimed in any of claims 7 to 17, wherein said screw is mechanically bonded sialon screw sections by shrink fit.

19. Apparatus as claimed in any of claims 7 to 18, wherein said screw is a monolithic construction of sialon ceramic.

20. A method of forming a semisolid slurry from a liquid metal alloy, comprising the steps of cooling the alloy below its liquidus temperature whilst applying shear at a sufficiently high shear rate and intensity of turbulence to convert the alloy into its thixotropic state, wherein shear is applied to the alloy by means of an extruder having at least two screws which are at least partially intermeshed.